

# A High Fidelity Computational Tool for Modeling Thermal Vent Systems in Cryogenic Tanks, Phase I

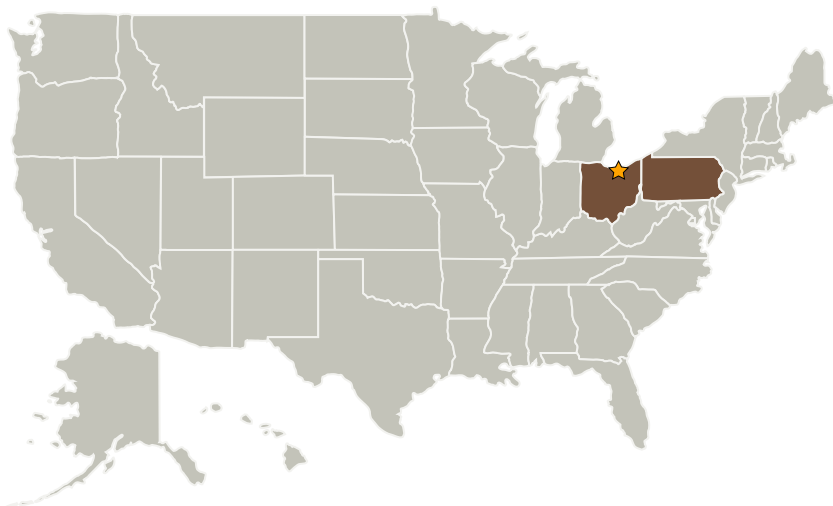
Completed Technology Project (2009 - 2009)



## Project Introduction

Control and management of cryogenic propellant tank pressures in low gravity is an important technical challenge to overcome for future long duration space missions. Heat leaking into the propellant tanks leads to self-pressurization of the tank due to vaporization. Advanced techniques such as thermodynamic vent systems (TVS) are currently being designed for low-gravity space systems. However, these systems are more complex to analyze and system level tools based on lumped, homogeneous models are inadequate for determining sensitivities to multi-dimensional fluid transport and dispersed multi-phase effects. The innovation proposed here is a comprehensive, CFD framework to support analyses of cryogenic tank management systems that will incorporate both real-fluid equations of state for cryogenic fluid mixtures with rigorous fluid property definitions, as well as an advanced dispersed phase spray model that permits non-equilibrium drag and heat transfer with the surrounding continuum fluid. The proposed effort will evaluate various sub-models for the vaporization/condensation of the cryogenic fluid droplets in an environment that includes a mixture of vapor and non-condensable gas. This technology will impact cryogenic systems for long duration space exploration activities.

## Primary U.S. Work Locations and Key Partners



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## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Glenn Research Center (GRC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★ Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
CRAFT Tech - Combustion Research and Flow Technology	Supporting Organization	Industry	Pipersville, Pennsylvania

Primary U.S. Work Locations	
Ohio	Pennsylvania

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX14 Thermal Management Systems
  - └ TX14.1 Cryogenic Systems
    - └ TX14.1.1 In-space Propellant Storage & Utilization